

Award Number: DAMD17-06-M-6014

TITLE: NASA Guideview and BMIST Integration

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REPORT DATE: September 2006

TYPE OF REPORT: Annual

PREPARED FOR: U.S. Army Medical Research and Materiel Command
Fort Detrick, Maryland 21702-5012

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REPORT DOCUMENTATION PAGE				Form Approved OMB No. 0704-0188	
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1. REPORT DATE (DD-MM-YYYY) 01-09-2006		2. REPORT TYPE Annual		3. DATES COVERED (From - To) 14 Oct 05 – 30 Sep 06	
4. TITLE AND SUBTITLE NASA Guideview and BMIST Integration				5a. CONTRACT NUMBER	
				5b. GRANT NUMBER DAMD17-06-M-6014	
				5c. PROGRAM ELEMENT NUMBER	
6. AUTHOR(S) M Sriram Iyengar, Ph.D. E-Mail: msriram@ems.jsc.nasa.gov				5d. PROJECT NUMBER	
				5e. TASK NUMBER	
				5f. WORK UNIT NUMBER	
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) NASA Johnson Space Center Houston TX 77058				8. PERFORMING ORGANIZATION REPORT NUMBER	
9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS(ES) U.S. Army Medical Research and Materiel Command Fort Detrick, Maryland 21702-5012				10. SPONSOR/MONITOR'S ACRONYM(S)	
				11. SPONSOR/MONITOR'S REPORT NUMBER(S)	
12. DISTRIBUTION / AVAILABILITY STATEMENT Approved for Public Release; Distribution Unlimited					
13. SUPPLEMENTARY NOTES					
14. ABSTRACT BMIST-J is a an electronic medical record system developed for Pocket PCs (Windows Mobile) by TATRC. GuideView is a system for delivering structured, interactive, multi-modal clinical guidelines on multiple platforms including Pocket PCs. It provides clinical guidelines simultaneously using voice, text, pictures, video, and animation. The objective of this research project was to integrate the two technologies. Version 1 of BMIST-GuideView was developed in the dot-net framework and successfully accomplishes the goal.					
15. SUBJECT TERMS EMR, clinical guidelines.					
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT	b. ABSTRACT	c. THIS PAGE			USAMRMC
U	U	U	UU	8	19b. TELEPHONE NUMBER (include area code)

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Introduction

Personal Digital Assistants (PDAs) are powerful computers increasing in popularity due to their powerful capabilities and a form factor that facilitates portability and mobile computing. PDAs based on the Windows Mobile Operating System are often referred to as PocketPCs.

BMIST-J, developed at TATRC is an Electronic Medical Record System designed to operate on PocketPCs. Due to its sophisticated capabilities and ease-of-use it is the *de facto* standard EMR for mobile devices.

GuideView, developed at the Medical Informatics Health Care Systems, NASA Johnson Space Center, is a technology for developing and delivering interactive, structured, multi-modal clinical guidelines on a variety of platforms including over the web, stand-alone Windows, and PDAs. The system is designed to assist Non-physician care providers (NPCPs) perform diagnosis and treatment. A user acceptability study performed prior to the start of the current MIPR project was published in [1]

The goal of the current project is to integrate the two technologies to produce an integrated system with extended capabilities of not only recording medical conditions but also providing easy-to-use guidelines on providing medical care.

Body

GuideView consists of two components, the GuideView Author and the GuideView Viewer. The former enables production of GuideView format clinical guidelines that can be saved as files. The latter reads GuideView compatible files and displays it in a structured, discourse format together with text, voice, pictures, video/animations.

The tasks originally proposed under this development project and the results are listed below.

1. Study and understand existing BMIST-J code.

Task completed. Two versions of BMIST-J code were studied. The latest version was received Sept 9, 2006 from TATRC and extensively analyzed. We are now very confident that we understand program structure for the purposes of integration of GuideView into BMIST-J.

2. Develop basic version of GuideView Viewer in C# to facilitate integration with BMIST-J.

Task completed. The original version of GuideView Viewer was written in the Flash system (Macromedia/Adobe). This had to be converted into the dot-net framework using the C# programming language. In addition, it was realized that two versions had to be

created corresponding to VGA and non-VGA display PocketPCs. For example, the HP IPAQ 4705 supports VGA but the HP IPAQ 2400 series does not.

Other system requirements for BMIST-GuideView include the latest Windows Mobile 2005 operating system together with dot-net framework and Compact SQL. The last two are also required for BMIST-J alone and do not represent additional requirements.

3. Add video/output capability to GuideView-BMIST form.

Task completed. The GuideView-BMIST form can provide full-motion video playback of files stored in WMV format. Audio playback of MP3 files is also available. Both of these rely on the built-in Windows Media Player on Pocket PCs under Windows Mobile.

4. Integrate GuideView into BMIST-J

Task completed. GuideView has been integrated into BMIST-J in two ways. In the first, GuideView is available under the Tools menu on the main BMIST-J screen. (See Figure 2 below) In addition, GuideView has been integrated in a context-sensitive way under the BMIST-J Encounter functionality as follows.

After a patient has been created in BMIST-J, click on the Encounter button. On the resulting BMIST-J Encounter screen the GuideView button appears at lower right but is grayed-out. It will become active only if there is an existing GuideView guideline for a particular complaint. To see this happening, select 'Eye' from the BMIST-J Chief Complaint list. Next select either 'pain', 'redness' or 'foreign-object' in the complaint details selection. At this point the GuideView button becomes active. Clicking on it brings up a GuideView guidelines that helps the user diagnose and treat common causes of eye redness. These include foreign object in the eye (Conjunctiva, lower eyelid, upper eyelid). Eye abrasion, bacterial and viral conjunctivitis. (See Figure 1 below)

After the desired GuideView steps have been completed click the exit button to return to BMIST-J.

5. Add speech input capability to GuideView

Voice command input exists in the Windows version of GuideView. The feasibility of adding it to the Windows Mobile version of GuideView was investigated extensively. Contacts were made to Microsoft Research for this purpose and discussions were held with Microsoft engineers. The conclusion was that at the current time the hardware platforms may not be powerful enough to support speech recognition. Therefore, this feature was postponed till a later time.

6. Review tool with user community. Refine based on user feedback.

After the first version of BMIST-GuideView was completed, CAB installer files were created and sent electronically to engineers at TATRC and also to Tommy Morris. John Pajak was able to successfully install the system on a Windows Mobile 2005 platform (DELL AXIM Hv3). He reviewed the software and several discussions were held by email and phone. He offered valuable suggestions. These included integrating the diagnosis found using GuideView with the BMIST-J electronic record. He also suggested a software switch for turning voice output On or Off according to the user's preferences. We see no difficulty implementing these suggestions. In addition, we realized that a formal usability study would yield significant benefits to guide future versions.

Mr Pajak reported that when a particular path traversed through GuideView resulted in an error. This was debugged and traced to a missing image file. The image file was emailed to Mr pajak with instructions for installation. Mr Pajak also reported choppy quality for playback of video on the Dell AXIM platform. We were unable to reproduce this on our available platforms (HP IPAQ 2400 series and 4705 series). We need to obtain a Dell Axim for testing and this is in progress.

Key Research Accomplishments

The following were the key accomplishments of this research.

1. GuideView code has been developed in a general purpose extensible software development environment, ie the Dot-net Framework using C#. This is a significant advance since the first version was on a prototyping platform, namely Flash. There are numerous benefits from this new version including the ability to easily produce versions for multiple target platforms (Desktop, PocketPC, Windows Mobile cell phones). In addition significant benefits are gained in terms of scalability and extensibility.
2. GuideView has been integrated in a context-sensitive way with BMIST-J. This represents a useful added capability with respect to diagnosis and treatment, for BMIST-J. GuideView capabilities are also enhanced by access to an EMR, specifically, BMIST-J.

Reportable Outcomes

The outcomes have been reported in the Body section above.

References

1. Iyengar, MS, Sarkar, S, Bacal K, Defouw, G, McCulley, P, Hurst, V, (2005) GuideView: Structured Multimodal Delivery of Clinical Guidelines. Proceedings of AMIA2005, Washington DC

Conclusions

GuideView was successfully integrated with BMIST-J in a context-sensitive manner. Analysis and review of this first version has already yielded suggestions for the next version. Current Pocket-PC hardware cannot easily support voice commanding.

Appendix

The following photographs illustrate the integrated BMIST-GuideView developed in the course of this research.

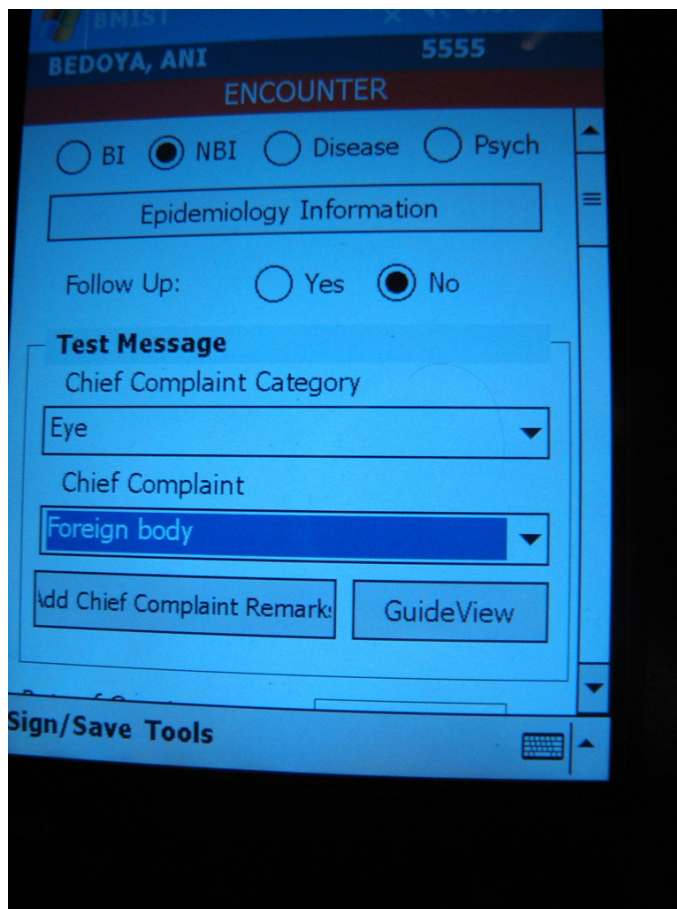


Figure 1: GuideView button active under Chief complaint “Foreign Body” under Complete Category “Eye”.



Figure 2: GuideView under Tools menu of main BMIST-J screen.